

Contents

1. Introduction to Sedimentology and Petroleum Geology . . .	1
2. Textures	4
Grain Size	4
Presentation of Grain-Size Distribution Data	7
Significance of Grain-Size Parameters	11
Grain Shape	14
3. Sediment Transport	16
A Little About Hydrodynamics	16
Flow in Rivers and Channels	17
Bed Forms	21
Different Types of Sediment Transport	22
4. Description of Sedimentary Rocks and Facies	35
Layering and Lamination	36
Current Ripples and Cross-Bedding	38
Erosion Structures on the Underside of Sand Beds (<i>Sole Structures</i>)	43
Structures on the Upper Surface of Beds	46
Deformation Structures	46
Concretions	50
Trace Fossils	50
5. Sedimentary Facies	55
Facies Analysis	55
Alluvial Fans	56
The Water Budget	60
Glacial Sediments	61
Desert	65
Lacustrine Deposits	67
River Deposits	70
Delta Sedimentation	75
River-Dominated Deltas (Mississippi Type)	78
Stability in a Delta	83
Tide-Dominated Deltas	84
Wave-Dominated Deltas	85

Coastal Sedimentation Outside Deltas	89
The Shore Zone	89
Prograding Beach and Barrier Sequences	91
Barrier Islands	92
Tidal Sedimentation	95
Shallow Marine Shelves	99
Continental Slopes	102
Submarine Canyons	104
Sedimentation Along Island Arcs and Submarine Trenches	107
6. Chemical and Mineralogical Factors Which Influence Sedimentological Processes	112
Ionic Potential	113
Hydrolysates	114
Redox Potentials	115
pH	116
Eh-pH Diagrams	116
Coefficients of Distribution	118
Isotopes	119
Clay Minerals	121
7. Weathering and Geochemical Processes	126
Mechanical Weathering	126
Biological Weathering	127
Chemical Weathering	127
Weathering Profiles (Soil Profiles)	127
Distribution of Clay Minerals and Other Authigenic Minerals as a Function of Erosion and Weathering	132
Sandstones	136
Geochemical Processes in the Ocean	138
Circulation of Water in the Oceans	142
Clastic Sedimentation in the Oceans	144
8. Carbonate Sediments	147
Carbonate-CO ₂ Systems in the Sea	150
Geochemistry of Carbonate Minerals	151
Classification of Carbonate Rocks	152
Fossils	156
Modern Carbonate Sedimentation Environments	160
Sedimentary Facies	162
Reefs	165
The Role of Algae in Carbonate Sedimentation	168
Coccolithophores	171
Pelagic Carbonate Deposits	174
Carbonate Diagenesis	175
Lithification of Carbonate Sediments	176
Dolomitisation	181

9. Other Biogenic and Chemical Sediments	187
Silica (SiO ₂) Deposits	187
Evaporites	190
The Sabkha Model	193
Evaporites in Lakes and Inland Seas	196
Evaporation of Groundwater	197
The Stability of Gypsum and Anhydrite During Diagenesis	197
Iron- and Manganese-Rich Sediments	198
Phosphorite Deposits	202
10. Stratigraphy	205
Lithostratigraphy	206
Biostratigraphy	207
Time Stratigraphy	208
The Relationship Between Lithostratigraphy, Biostratigraphy and Chronostratigraphy	210
Palaeomagnetism and Magnetic Stratigraphy	211
Radiometric Age-Dating Methods	213
Dynamic Stratigraphy	217
11. Seismic Stratigraphy and Basin Analysis	221
Interpretation of Lithology and Sedimentary Facies by Means of Seismic Profiles	226
Filling of Sedimentary Basins	227
Tectonic Boundaries	229
Changes in Sea Level	229
Geothermal Gradients in Sedimentary Basins	235
Sedimentation and Isostatic Equilibrium	238
Fracturing and Subsidence of the Continental Crust (Rifting)	240
Subsidence Along Passive Margins	242
Subduction Zones	244
12. Diagenesis in Clastic Sediments	245
Diagenetic Processes in Sandstones	249
13. Petroleum Geology	269
How Petroleum is Formed in Source Rocks, Migrates, and Accumulates in Reservoir Rocks	269
History	270
Formation of Petroleum – Production of Organic Matter	271
Early Diagenesis of Organic Matter	276
Kerogen	277
Composition of Petroleum	282
Migration of Petroleum	284

Biodegradation	287
Permeability and Porosity	289
Capillary Pressure	291
Osmosis	294
Hydrocarbon Traps	295
Drilling for Oil	301
Composition of Porewater in an Oil Field	304
Formation of Reservoir Rocks	305
Carbonate Reservoirs	308
14. Well Logs	312
Electric Logs	313
Radioactive Logs	314
Density Logs	316
Sonic Logs or Acoustic Logs	316
Dipmeter Logs	318
Temperature Logs	318
Caliper Logs	319
Interpretation of Environment of Deposition by Means of Well Logs	320
15. Plate Tectonics and Oil Prospecting	323
Basins Formed During Diverging Plate Movements	324
Conservative Plate Boundaries	329
16. Production Geology	333
Reservoir Energy	333
Enhanced Oil Recovery Methods (Tertiary Oil Recovery)	338
Bibliography	343
Subject Index	357